SYSTEM VOLTAGE LIMITS
FOR SATISFACTORY
TELEVISION RECEIVER OPERATION

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SYSTEM VOLTAGE LIMITS FOR SATISFACTORY TELEVISION RECEIVER OPERATION

Most television receivers are designed to perform satisfactorily within a voltage range of 110 to 125 volts. Some television receivers are designed with automatic voltage regulating power supplies and such receivers will rarely perform unsatisfactorily due to poor voltage supply. Receivers which do not incorporate voltage regulation into the design may show considerable change in picture size and focusing if the voltage swings over a wide range such as from 110 to 125 volts.

Design Voltage Limits

The distribution lines of REA-financed systems, if operating within the design voltage limits, will generally meet the requirements of television receivers. The design voltage limits are as follows :

Design Voltage Limits of REA Distribution Systems

(Referred to a 120-volt base)

Substation Output

120 volts to 124 volts during light load

124 volts to 127 volts during full load

Distribution Line

116 volts minimum to 127 volts maximum

(This includes 8 volts maximum drop from substation to end of line)

Consumers' Meter Socket

110 volts minimum to 127 volts maximum

(This includes 6 volts maximum drop from primary line to meter socket)

Consumers' Service Outlets

107 volts minimum to 127 volts maximum

(This includes 3 volts maximum drop from meter socket to service outlet)

Operating Voltages

It should be noted that the voltage range of 107 to 127 volts at the point of utilization are maximum limits used for design purposes. With the substation output and the line voltage held within the limits given, all consumers will be supplied power at voltage levels between 110 and 125 volts at the service outlets. The minimum design voltage (107 volts) will only be supplied to a consumer at the end of a maximum loaded (8 volts

drop) line when that consumer uses maximum load at the same time the line carries maximum load. This operating condition might exist for approximately one hour per day during the period of system annual peak load normally lasting two or three weeks. The maximum design voltage (127 volts) will only be supplied to a consumer at or very near the output of the substation when that consumer uses minimum load during the period of system annual peak load. This operating condition is rarely experienced. Consumers located between the substation and the mid point of the line may expect the voltage to be from 117 to 125 volts and have a maximum swing of plus or minus 3 volts. Consumers located between the mid-point and the end of the line may expect the voltage to be from 110 to 117 volts and have a maximum swing of plus or minus 3 volts. These voltages are well within the requirements of television receivers.

Receiver Operation

Television receivers which have been tuned and aligned to operate at 118 volts will perform satisfactorily on a distribution system which is operated within the voltage limits given above. Certain receivers may be more sensitive to voltage changes than others, but such receivers may be tuned and aligned to operate within the voltage range supplied. The voltage at the consumers' socket may be recorded to determine the supply voltage swing through which the television receiver must operate during the evening viewing period.

A receiver which has been operating satisfactorily may suddenly or gradually become sensitive to small line voltage variations. As the vacuum tubes within the receiver age, their stability decreases to the point where their operation may be more critical to supply voltage changes. This shows as a marked decrease in picture size, defocussing of the picture, loss of synchronization, and with certain tubes the screen may go completely black with comparatively small reductions in line voltage. This difficulty must be corrected within the set.

In some cases voltage disturbance to receivers is caused by voltage flicker rather than slow changes in voltage level. Voltage flicker may result from motors used by the consumer. Flicker will cause a rapid decrease in picture size, the picture slowly returning to its original size following the rapid change. This disturbance may be reduced by connecting the receiver to a branch circuit not used to supply motors. In order to overcome flicker it is sometimes necessary to increase the size of service conductors.

An adjustable voltage source such as a "Powerstat"* or "Variac"** is ideal to use when checking the effect of voltage variation on television receivers. The adjustable

voltage source should be set at approximately 118 volts before plugging in the television receiver. An indicating voltmeter having a stated accuracy within plus or minus 1% should be used to measure the output voltage of the adjustable voltage source. By employing an adjustable voltage source it is possible to observe the operation of the television receiver at the same voltage levels that have been recorded at the consumer's outlet.

Small automatic voltage regulating transformers*** are available for use with television receivers. With the use of a regulator it is possible to maintain constant voltage and eliminate flicker problems.

Corrective Measures

The key to the voltage problem on a rural distribution system is to maintain correct output voltage at the substation. A large percentage of voltage supply problems have been corrected by installing and properly adjusting voltage regulators in the substation. Voltage recordings at the substation output are helpful in maintaining correct voltage on the system.

Overloaded distribution lines cause low voltage problems on a system. The voltage at the end of each line should be periodically checked to assure proper voltage supply. A distribution line which has nearly eight volts drop should be checked during the time of system annual peak to determine if the design limit is being exceeded.

Long service conductors are sometimes the cause of low voltage at the utilization outlet. This can be corrected by increasing the service conductor size or by moving the distribution transformer closer to the consumer's meter. Larger distribution transformers should not be installed to correct excessive drop unless the present transformer is thermally overloaded.

Excessive voltage drop may occur in the consumer's wiring. This may be checked by measuring the voltage drop of a circuit between no load and full load. It is the consumer's responsibility to install adequate wiring.

* "Powerstat," manufactured by The Superior Electric Company, Bristol, Connecticut. Type 116.

** "Variac," manufactured by General Radio Company, 275 Massachusetts Avenue, Cambridge 39, Massachusetts. Type V-5MT.

*** Constant voltage transformer, manufactured by Sola Electric Company, 4633 W. 16th Street, Chicago 50, Illinois. Type CVH.